New records and new species of *Calliostoma* and *Bathyfautor* (Gastropoda: Calliostomatidae) from the Vanuatu, Fiji and Tonga

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KEYWORDS. Gastropoda, Trochoidea, Calliostomatidae, Vanuatu, Fiji, Tonga, *Calliostoma* n. sp.

ABSTRACT. New records of *Calliostoma* and *Bathyfautor* from Vanuatu, Fiji and Tonga are listed. *Calliostoma (Fautor) strobilos* n. sp., *C. (F.) chlorum* n. sp., *C. (F.) metabolicum* n. sp., *C. (Ampullotrochus) xylocinnamomum* n. sp. and *C. (Benthastelena) arx* n. sp. are described and compared with several similar *Calliostoma* species from the Indo-Pacific of which most are illustrated.

RESUME. De nouveaux relevés de *Calliostoma* et de *Bathyfautor* provenant du Vanuatu, des Fidji et des Tonga sont listés. *Calliostoma (Fautor) strobilos* n. sp., *C. (F.) chlorum* n. sp., *C. (F.) metabolicum* n. sp., *C. (Ampullotrochus) xylocinnamomum* n. sp. et *C. (Benthastelena) arx* n. sp. sont décrites et comparées avec des espèces analogues de *Calliostoma* de l'Indo-Pacifique dont la plupart sont illustrées.

INTRODUCTION

Thirty species of Calliostomatinae and Thysanodontinae were recorded from New Caledonia by Marshall (1995), based on material collected by French deep-sea expeditions conducted in the 1980s by the IRD (Institut de Recherche pour le Développement, Paris - ex-ORSTOM) and the MNHN (Muséum national d'Histoire naturelle, Paris). Subsequent expeditions were conducted in Wallis & Futuna [MUSORSTOM 7, 1992 (Richer de Forges & Menou 1993)], Vanuatu [MUSORSTOM 8, 1994 (Richer de Forges et al. 1996)], Fiji [MUSORSTOM 10, 1998 (Richer de Forges et al. 2000a); BORDAU 1, 1999 (Richer de Forges et al. 2000b)] and Tonga (BORDAU 2, 2000).
From these areas is coming into the MNHN collections an interesting molluscan material, with so numerous specimens that some of them have been studied only recently, bringing new information about poorly known species (sometimes only by juveniles). In this material, numerous trochids are present and especially Calliostomatinae. The present paper reports on new records and new species of *Calliostoma* found in this material and coming especially from an area covering Vanuatu, Fiji and Tonga. They are mainly compared to species from New Caledonia (Marshall, 1995), Japan (Sakurai, 1994; Higo, Callomon & Goto, 1999; Sasaki, 2000), Australia (Wilson, 1993) and Philippines (Bozzetti, 1997a & 1997b; Vilvens, 1999 & 2000).

Abbreviations

Repositories

BM(NH) : The Natural History Museum, London, United Kingdom.
IMT : Institute of Malacology of Tokyo, Tokyo, Japan.
MNHN : Muséum national d'Histoire naturelle, Paris, France.
NSMT : National Museum of Science, Tokyo, Japan.
ZMA : Zoölogisch Museum, Amsterdam, The Netherlands.

Other abbreviations

H : height
W : width
HA : height of the aperture
P1, P2, P3, ...: primary cords (P1 is the most adapical)
S1, S2, S3, ...: secondary cords (S1 is the most adapical)
stn : station
dd : no live-taken specimens present in sample
lv : live-taken specimens present in sample
sub : subadult specimen
juv : juvenile specimen

Remark about distribution ranges

Regarding the distribution of the new species and the extension of the distribution of known species, the range is taken from the internal intervals of the two extremes values.

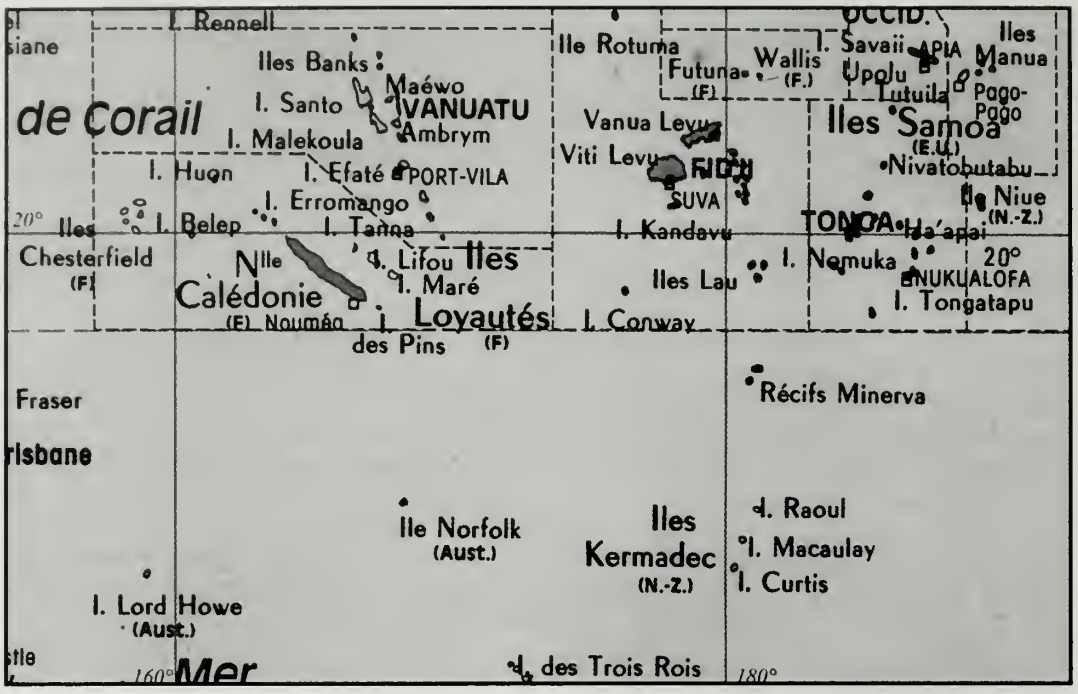


Figure 1. – Map of the Vanuatu-Fiji-Tonga-Kermadec area (names in french).

SYSTEMATICS

We follow here the classification of Marshall (1995) and Bouchet & Rocroi (in press).

Superfamily **TROCHOIDEA** Rafinesque, 1815
Family **CALLIOSTOMATIDAE** Thiele, 1924
Subfamily **CALLIOSTOMATINAE** Thiele, 1924
Tribe **Calliostomatini** Thiele, 1924
Genus ***Calliostoma*** Swainson, 1840
Type species: *Trochus conulus* Linnaeus, 1758 (by s.d. Herrmannsen, 1846) – Recent, Mediterranean Sea.

Subgenus ***Fautor*** Iredale, 1924
Type species : *Ziziphinus comptus* A.Adams, 1855 (by o.d.) – Recent, southern Australia.

Calliostoma (Fautor) boucheti Marshall, 1995
Figs 7-8

Calliostoma (Fautor) boucheti Marshall, 1995: 389-392, figs 3, 7-9, 117, 150, 155. Type locality: off southern New Caledonia.

Material examined. Vanuatu. MUSORSTOM 4: stn DW159, 18°46'S, 163°16'E, 585 m, 1 dd.

Distribution. South of Ile des Pins, southern New Caledonia and northern Norfolk Ridge, 233-650 m, Vanuatu, 585 m.

Calliostoma (Fantor) paradigmatum Marshall, 1995

Calliostoma (Fautor) paradigmatum Marshall, 1995: 395-397, figs 13-15, 119, 155. Type locality: southern New Caledonia.

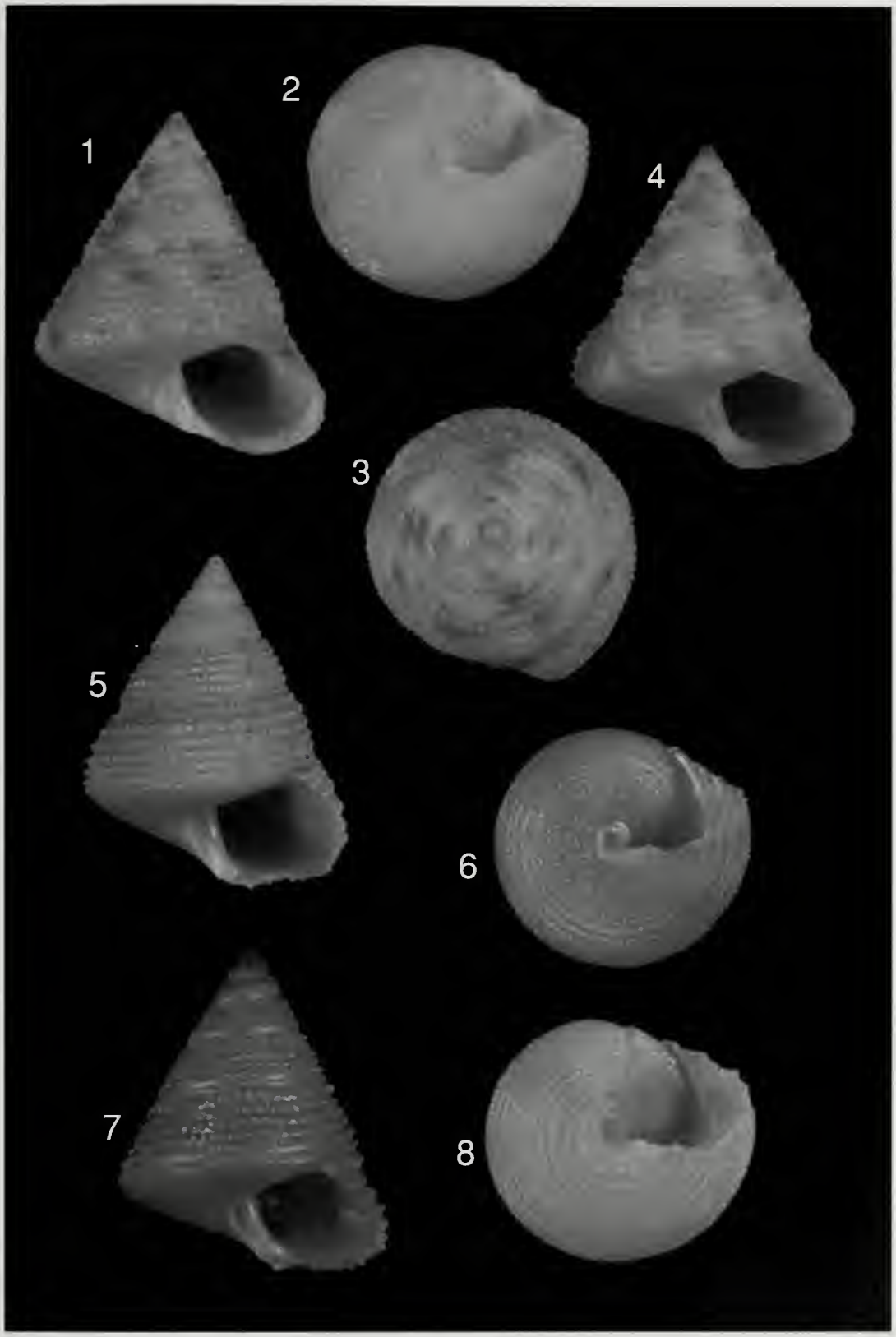
Material examined. Tonga. BORDAU 2: stn DW1517, 21°21'S, 175°07'W, 342 m, 1 dd. – Stn DW1549, 20°38'S, 175°00'W, 500 m, 1 dd. – Stn DW1569, 21°02'S, 175°19'W, 433 m, 1 dd juv.

Distribution. Off Ile Surprise, northern New Caledonia, 585 m, South of Ile des Pins, southern New Caledonia, 470-775 m, and Tonga, 342-500 m.

Calliostoma (Fautor) houbricki Marshall, 1995
Figs 48-49

Calliostoma (Fautor) houbricki Marshall, 1995: 399-401, figs 22-24, 122, 156. Type locality: southern New Caledonia.

Material examined. Vanuatu. MUSORSTOM 8: stn DW976, 19°25'S, 169°27'E, 160-182 m, 1 dd. - Stn DW1021, 17°43'S, 168°37'E, 124-130 m, 1dd. – **Fiji.** MUSORSTOM 10: stn CP1341, 16°52.5'S, 177°43.7'E, 500-614 m, 1 dd juv. – Stn CP1358, 17°48.5'S, 178°46.7'E, 80-120 m, 1 dd and 1 dd juv. – Stn CP1371, 18°12.4'S, 178°32.8'E, 135-151 m, 1 dd. - SUVA 2: stn BS26, 18°08.9'S, 178°29.7'E, 113 m, 1 dd juv.



1-3. *Calliostoma (Fautor) strobilos* n. sp., holotype MNHN, Fiji, 300-450 m [BORDAU 1, stn DW1455], 14.4 x 11.9 mm; **4.** *C. (F.) strobilos* n. sp., paratype MNHN, Fiji, 300-450 m [BORDAU 1, stn DW1455], 13.6 x 11.6 mm; **5-6.** *C. (F.) necopinatum* Marshall, 1995, paratype MNHN, New Caledonia, Atoll of Surprise, 255 m [MUSORSTOM 4, stn DW164], 12.7 x 9.8 mm; **7-8.** *C. (F.) boucheti* Marshall, 1995, paratype MNHN, southern New Caledonia, 527 m [CHALCAL 2, stn DW72], 11.5 x 9.2 mm.

Distribution. Off northern and southern New Caledonia, 73-110 m, and Vanuatu, 113-500 m.

Calliostoma (Fautor) strobilos n. sp.
Figs 1-4

Type material. Holotype MNHN (unnumbered). Paratype MNHN (unnumbered).

Type locality. Fiji, Somosomo Strait between Vanua Levu and Taveuni, 16°47' S, 179°58' E, 300-450 m [BORDAU 1, stn DW1455].

Material examined. Fiji. BORDAU 1: stn CP1394, 16°45'S, 179°59'E, 416 m, 1 dd sub and 1 dd juv. - Stn DW1451, 16°45'S, 179°59.5'E, 400-460 m, 1 dd and 1 dd juv. - Stn DW1455, 16°47'S, 179°58'E, 300-450 m, 2 dd (holotype and paratype).

Distribution. Fiji, 416 m.

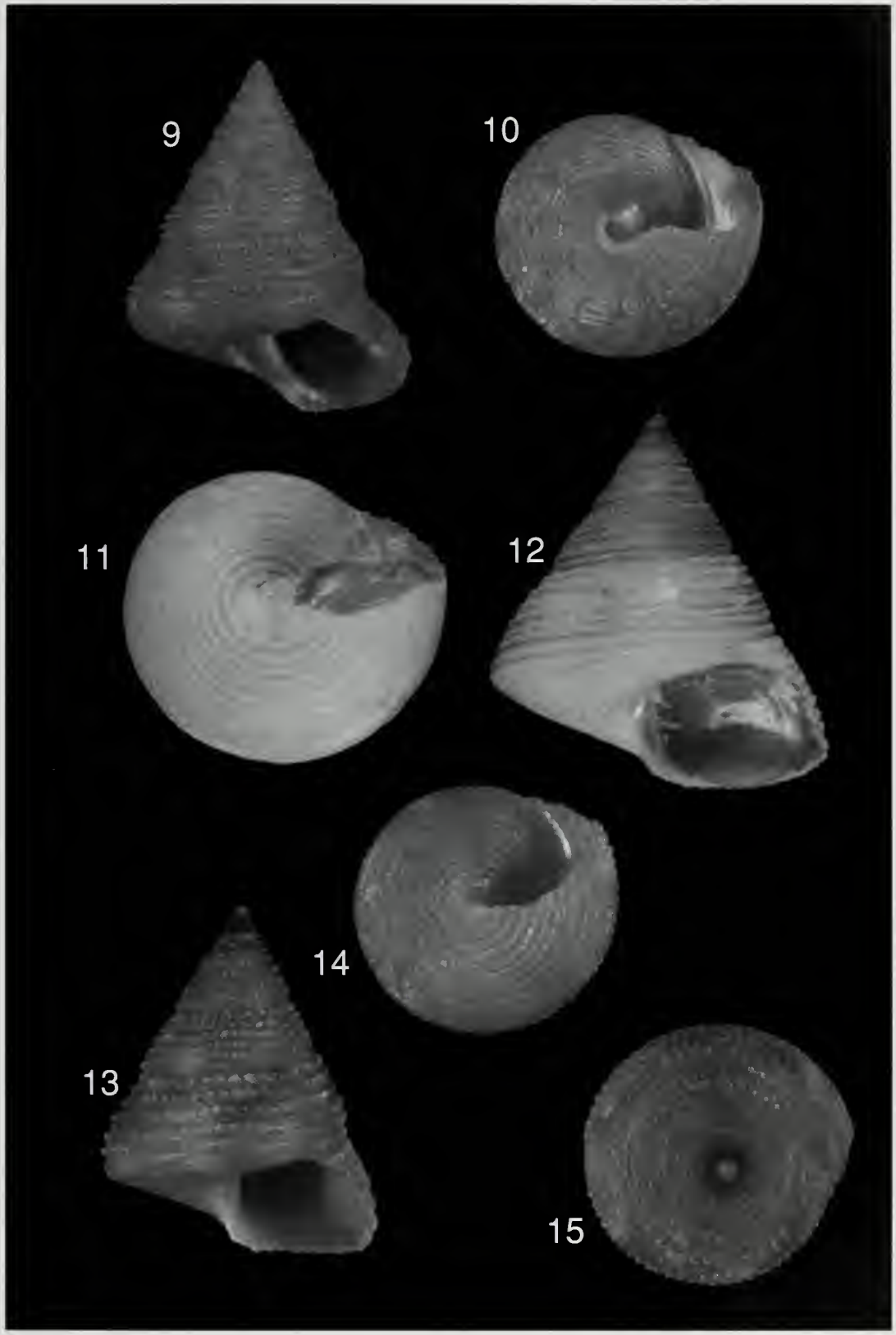
Diagnosis. A *Calliostoma* species of moderate size, higher than wide, conical in shape, rather strong, with a subangular periphery, about 10 granular spiral cords on last whorl and a stronger adapical cord; the base is weakly convex, bearing about 15 smooth spiral cords and no umbilicus.

Description. *Shell* moderately tall for the genus (height up to 14.5 mm, width up to 11.9 mm), conical in shape; spire rather high, height about 1.2x width, about 3.8x higher than aperture, anomphalous (at most a weak umbilical slit).
Protoconch ca 200 µm in diameter, of 1.25 whorl, covered by reticulate network of fine ridges; apical fold straight with a weak rounded terminal varix.
Teleoconch of 7 whorls, bearing spiral granular cords; whorls straight or weakly convex, last whorl more convex with abapical part possibly swollen (paratype). Suture visible, impressed, not channelled. First whorl of teleoconch convex, sculptured by four primary cords; all cords appearing immediately, first subgranular and becoming clearly granular on the second half of the whorl; P1 weakest, P3 strongest, P2 and P4 slightly weaker than P3, P4 almost completely covered by next whorl; interval between P1 and P2 narrowest, interval between P3 and P4 broadest; prosocline axial ribs in the intervals between cords, connecting granules of cords; interval between ribs similar in size to the ribs. On second whorl, all spiral cords stronger, P1 as strong as other cords; interval between P1, P2 and P3 similar in size to cords; interval between axial ribs becoming 2 times larger than width of ribs; beads of cords rounded, thicker than cords and ribs, isolated but connected by cord; area between P3 and P4 concave. S2 appearing on the second half of third whorl, S1 appearing a quarter of whorl after S2, both granular; P4 partly emerging from suture. S3 appearing at the beginning of fourth whorl, also granular; P1 strongest, with thick beads closely packed; axial ribs becoming obsolete. On fifth whorl, beads of P1 becoming bluntly sharp, adapically oriented at 45°. At end of sixth whorl, two tertiary cords appearing between P1 and S1 and between S1 and P2. On last whorl, primary and secondary cords similar in size, except P1 stronger and P4 peripheral, weaker than other cords; interval between primary and secondary cords of the same size as cords; additional tertiary cords may appear between S2 and P3 (holotype) or between P2 and S2 (paratype).
Aperture subcircular; outer lip rather thick; basal part curved, meeting outer lip without angle and inner lip with at the most a rounded angle.
Columella slightly curved, slightly oblique, smooth; callus completely covering umbilicus.
Base moderately convex, with 15-17 smooth or weakly subgranular spiral cords, broader in umbilical area than at periphery; interval between cords more or less of the same size as cords; space between cords smooth or with very weak axial threads.
Colour of protoconch orange; teleoconch cream with large orange blotches; base paler, yellowish white; callus white.
Operculum unknown.

	H	W	HA	H / W	H / HA
holotype	14.4	11.9	3.7	1.21	3.89
paratype	13.6	11.6	3.6	1.17	3.78
specimen stn 1451	14.5	11.8	3.8	1.23	3.82

Table 1. - *Calliostoma (Fautor) strobilos* : Shells measurements in mm.

Discussion. The new species is rather close to *Calliostoma (Fautor) necopinatum* Marshall, 1995 (Figs 5-6) from New Caledonia, but this species has a weakly cyrtoconoid spire, more convex whorls, P1 similar in size and shape to the other primary and secondary cords, larger distance between secondary cords appearing (at least 2 whorls), smaller and more close packed beads on cords, and narrower intervals between cords.



9-10. *Calliostoma (Fautor) metivieri* Marshall, 1995, MNHN, southern New Caledonia, 400 m [LITHIST, stn DW13], 16.6 x 13.4 mm; **11-12.** *C. (Kombologion) filiareginae* Sakurai, 1994, holotype NSMT, Japan, 17.8 x 14.6 mm; **13-15.** *C. (Fautor) chlorum* n. sp., holotype MNHN, Fiji, 300-370 m [BORDAU 1, stn DW1454], 13.6 x 10.4 mm.

C. (F.) strobilos n. sp. may also be compared to *C. (F.) boucheti* Marshall, 1995 (Figs 7-8) and *C. (F.) metivieri* Marshall, 1995 (Figs 9-10), both from New Caledonia. However, these species have finer spiral cords with distance between cords larger than cords, S1 appearing much later after S2 and higher spiral cords on the base. Moreover, *C. (F.) boucheti* is smaller and more colourful and *C. (F.) metivieri* has more convex whorls.

The new species superficially resembles *C. (Kombologion) filiaregiuae* Sakurai, 1994 (Figs 11-12) from Japan, but this species has a more conical shape, finer and more numerous spiral cords, an angulated periphery and a quadrangular aperture.

C. (F.) strobilos n. sp. may weakly remember *C. (Tristichotrochus) sakashitai* Sakurai, 1994 from Japan but this species shows an aperture that is smaller regarding the height of the shell, more convex whorls, only two spiral cords on first whorls and abapical spiral cords broader than the adapical ones on last whorls.

C. (F.) strobilos n. sp. may also be compared to *Calliostoma gendalli* Marshall, 1979 from Kermadec Islands, but this species is clearly different because it has an umbilicus and an abapical spiral cord stronger than the other cords.

Etymology. στρβιλοζ (Greek : spiral shell), used as a noun in apposition - with reference to the regular general shape of the shell.

Calliostoma (Fautor) chlorum n. sp.
Figs 13-15

Type material. Holotype MNHN unnumbered (13.6 x 10.4 mm). Paratypes: 6 MNHN (unnumbered).

Type locality. Fiji, Somosomo Strait between Vanua Levu and Taveuni, 16°46' S, 179°59' E, 300-370 m [BORDAU 1, stn DW1454].

Material examined. All type material. **Fiji**. BORDAU 1: stn DW1454, 16°46'S, 179°59'E, 300-370 m, 1 dd and 6 dd juv (holotype and paratypes).

Distribution. Fiji, 300-370 m.

Diagnosis. A *Calliostoma* species of moderate size, higher than wide, conical in shape, rather strong, with an elevated spire, a slightly depressed sutural area, an angular periphery; last whorl with about 10 granular spiral cords, an adapical cord stronger and the two abapical cords weaker; the base is almost flat, bearing about 12 smooth spiral cords and no umbilicus.

Description. *Shell* moderately tall for the genus (height up to 13.6 mm, width up to 10.4 mm), conical in shape; spire high, height about 1.3x width, about 4.2x x higher than aperture, anomphalous.

Protoconch ca 350 µm in diameter, of 1.25 whorl, covered by reticulate network of fine ridges; apical fold straight with a weak rounded terminal varix.

Teleoconch of 7 whorls, bearing spiral granular cords; whorls weakly convex. Suture only weakly visible, not channelled. First whorl of telcoconch convex, sculptured by four primary cords; all cords appearing immediately, granular with rounded nodules, evenly distributed; P1 weakest, P3 strongest, P4 almost completely covered by next whorl; prosocline axial ribs in intervals between cords, connecting granules of cords; distance between ribs 2 times larger than width of ribs. On second whorl, all spiral cords stronger, P1 still weaker; axial ribs of area between P1 and P2 and between P2 and P3 broader, distance between them becoming similar in size to ribs; area between P3 and P4 (still not visible) concave, axial sculpture reduced to weak fine close threads. S2 appearing at beginning of third whorl; beads of P1, P2 and P3 thick, rounded, closely packed; axial ribs becoming obsolete; P4 weakly emerging from suture. S1 and S3 starting at end of fourth whorl; P4 more visible, finely granular.

On fifth whorl, P1 strongest, S3 weakest. At end of sixth whorl, three tertiary cords appearing successively between P2 and S2, S1 and P2, and P1 and S1. On last whorl, primary and secondary cords similar in size, except P1 stronger, S3 weaker and P4 peripheral, smooth, much finer than other cords; interval between primary and secondary cords of the same size as cords; additional tertiary cords appearing between S2 and P3 and between P3 and S3.

Aperture subquadrate; interior of outer lip with fine lirae underlying the external cords; outer lip rather thick, curved; basal part almost straight, producing a rounded angle with outer lip and an almost right angle at meeting point with inner part.

Columella straight, almost vertical, smooth; callus completely covering umbilicus.

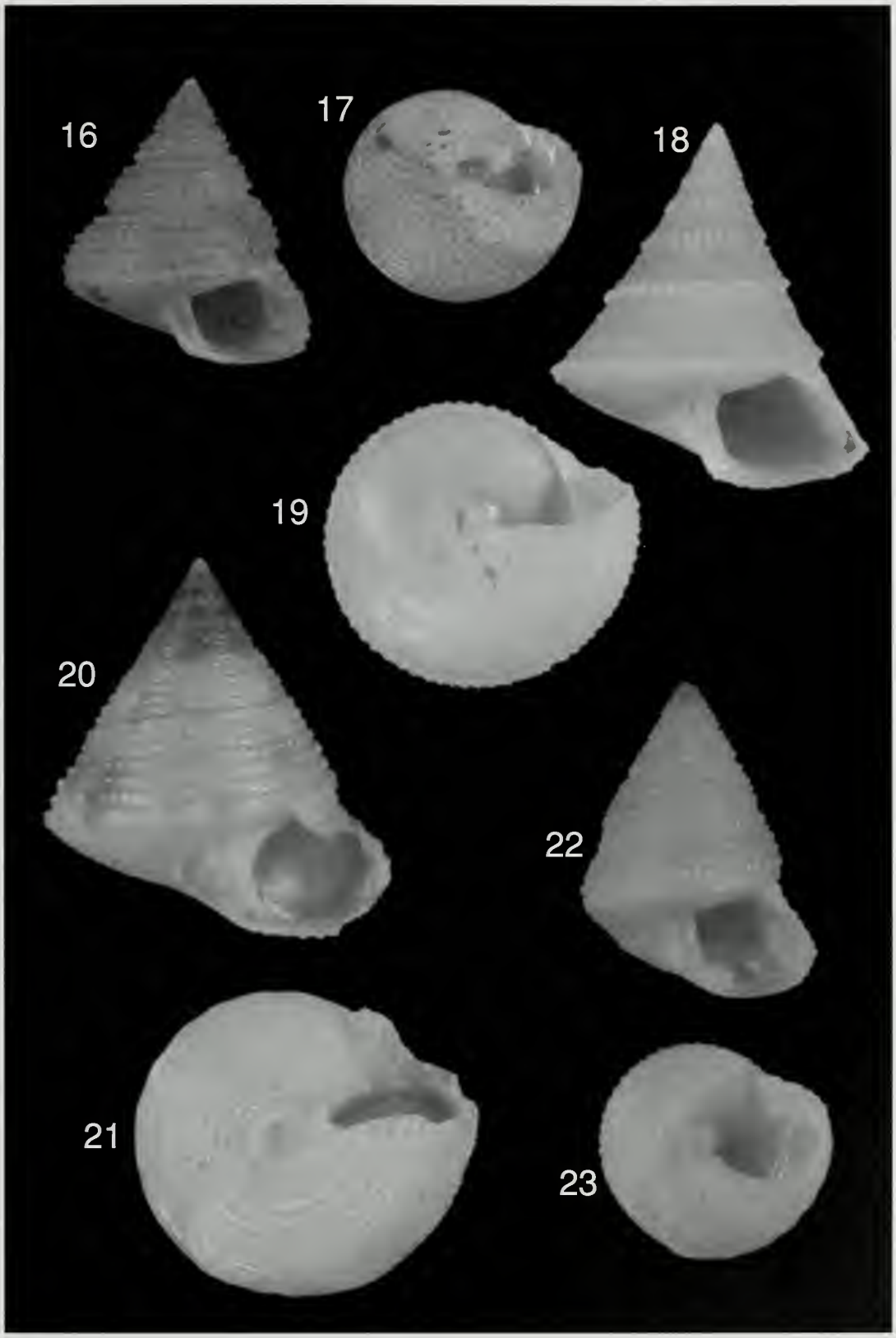
Base nearly flat, with 10 smooth spiral cords, weakly broader in umbilical area than at periphery; interval between cords of the same size as cords.

Colour of protoconch pink; first whorls pink, two following chocolate brown, two next nacreous caramel and last nacreous pink; broad pistachio blotches all around the spire; base paler, pinkish white; callus white.

Operculum unknown.

Discussion. The new species is close to *Calliostoma (Fautor) strobilos* n.sp. (Figs 1-4) from Fiji, but this species has a lesser H/W ratio, an aperture with a different shape, basal spiral cords more numerous and thinner; especially, ontogeny of secondary cords is different, with S1 appearing much later on the new species than on *C. (F.) strobilos* n.sp.

The new species is also close to *C. (F.) necopinatum* Marshall, 1995 (Figs 5-6) from New Caledonia, but



16-17. *Calliostoma (Tristichotrochus) wanipponensis* Okutani, 1969, holotype NSMT (Mo 69544), Japan, depth unknown, 10.1 x 8.8 mm; **18-19.** *Bathyfantor coriolis* Marshall, 1995, MNHN, Fiji, 304 m [MUSORSTOM 10, stn CP1342], 17.x15.9 mm; **20-21.** *Calliostoma (Fantor) jackelynae* Bozzetti, 1997, holotype MNHN, Philippines, Balicasag Is., 140 m, 17.5 x 15.8 mm; **22-23.** *C. (F.) comptum* A.Adams, 1854, lectotype BM(NH) (1968177), New Caledonia, 11.1 x 7.9 mm.

this slightly smaller species has a different ontogeny of secondary cords with S3 appearing clearly later after S1; it has also basal thinner and more numerous spiral cords.
C. chlorum n. sp. may also be compared to *C. (F.) boucheti* Marshall, 1995 (Figs 7-8) from New Caledonia, but this species has on the whorls finer spiral cords with smaller beads clearly separated and interval between cords broader than the cords; it has also more numerous and more granular basal spiral cords.
The new species may also remember *C. (Tristichotrochus) uranipponensis* Okutani, 1969 (Figs 16-17) from Japan but the spiral cords on the last whorl of this smaller species are smooth safe P1 and S1, and S3 is lacking, giving to the suprasutural area a more compressed shape.
C. chlorum n. sp. can be easily distinguished from *C. simplex* Schepman, 1908 because this Indonesian species has much finer basal cords with interval between them much broader than the cords.

Etymology. χλωροζ (Greek : yellowish green, pistachio like colour) - with reference to the green-like colour of the shell.

Calliostoma (Fautor) metabolicum n. sp.
Figs 24-28

Type material. Holotype MNHN (unnumbered). 2 paratypes MNHN (unnumbered).

Type locality. Vanuatu, NE of Espiritu Santo I., 15°04' S, 167°09' E, 208-210 m [MUSORSTOM 8, stn CP1102].

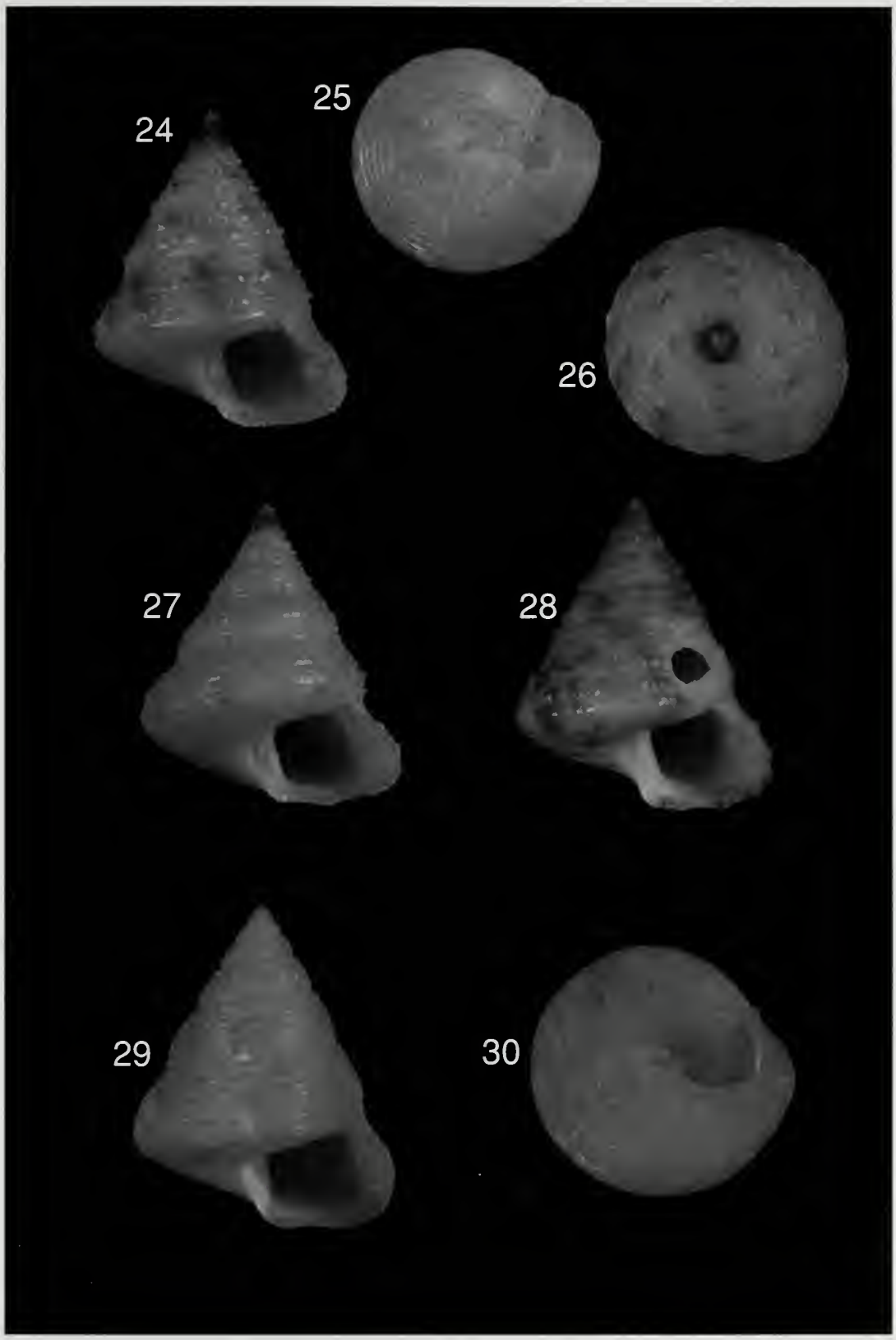
Material examined. All type material. **Vanuatu**. MUSORSTOM 8: stn DW1101, 15°04'S, 167°08'E, 205-210 m, 1 dd (paratype) - Stn CP1102, 15°04'S, 167°09'E, 208-210 m, 1 dd (holotype). – VOLSMAR: stn DW59, 21°00'S, 170°17'E, 320 m (paratype).

Distribution. Vanuatu, 210-320 m.

Diagnosis. A *Calliostoma* species of small size, higher than wide, conical in shape, rather strong, with a subangular periphery and an ovate, horizontally elongated aperture; whorls with about 6 variable in shape spiral cords on last whorl, granular to subgranular or even almost smooth, the two most abapical thick, the most abapical one smooth; the base is weakly convex, bearing about 10-12 smooth or weakly subgranular spiral cords and without umbilicus.

Description. *Shell* small for the genus (height up to 9.6 mm, width up to 7.6 mm), conical in shape, adapical half weakly coeloconoid in shape, abapical part cyrtoconoid; spire rather high, height 2.1x to 2.2x width, about 3.9x to 4.6x higher than aperture, anomphalous (at most a weak umbilical slit).
Protoconch ca 150-200 µm in diameter, of 1-1.25 whorl, covered by a network of fine ridges producing polygonal areas; apical fold straight with a low rounded terminal varix.
Teleoconch of 7 whorls, bearing spiral granular cords; first whorls weakly convex, next whorls more convex. Suture hard to see, neither impressed nor channelled. First whorl of teleoconch convex, sculptured by three primary cords; P3 appearing almost immediately, P2 starting a quarter of whorl after and P1 appearing at end of whorl; all cords granular with rounded beads; P1 weakest, P3 strongest, P2 only slightly weaker than P3; strong prosocline axial ribs connecting granules of spiral cords, interval between ribs similar in size to the ribs. On second whorl, P4 emerging slightly from suture, smooth; distance between P1 and P2 slightly smaller than distance between P2 and P3; interval between axial ribs 1.5-2 broader than ribs. On third whorl, interval between cords of same size as cords, P1 only slightly weaker than P2 and P3, P3 strongest. S2 appearing at the end of fourth whorl, thin and smooth; P4 more visible, still smooth; axial ribs becoming obsolete. On fifth whorl, S1 appearing, thin and smooth; S2 becoming subgranular. S3 absent. On last whorls, primary cords becoming subgranular (holotype and paratype stn DW1101) or staying granular (paratype stn DW59), except P4 smooth, low, peripheral; P3 and P4 strongest; secondary cords subgranular, sometimes nearly smooth (paratype stn DW1101); tertiary cords may appear between primaries and secondaries, smooth.
Aperture ovate, horizontally elongated; outer lip flaring, thin at rim, thickened within, lirate within with fine lirae underlying the external cords; basal part weakly curved, meeting outer lip without angle and inner lip with a slightly obtuse angle.
Columella nearly straight, slightly oblique, smooth; callus completely covering umbilicus.
Base weakly convex, with 10-12 smooth spiral cords; interval between cords smaller than cords; space between cords smooth or with very weak axial threads.
Colour of protoconch pinkish white; teleoconch pink to white nacreous, with green spots or sheens, and occasionally brown axial blotches (holotype and paratype stn DW59); base of same colours, but paler; callus white.
Operculum unknown.

Discussion. The new species shows some variability regarding the granularity of spiral cords and colours, but all the available specimens share the same peculiar shape of the aperture and the same ontogeny and number of spiral cords, on the whorls and on the base.
The new species is close to *Calliostoma (Tristichotrochus) takaseanus* Okutani, 1972 (Figs 29-30) from Japan, but in this species the spiral cords



24-26. *Calliostoma (Fautor) metabolicum* n. sp., holotype MNHN, Vanuatu, 208-210 m [MUSORSTOM 8, stn CP1102], 9.6 x 7.6 mm; **27.** *C. (F.) metabolicum* n. sp., paratype MNHN, Vanuatu, 205-210 m [MUSORSTOM 8, stn DW1101], 8.6 x 7.3 mm; **28.** *C. (F.) metabolicum* n. sp., paratype MNHN, Vanuatu, 320 m [VOLSMAR, stn DW59], 8.6 x 6.9 mm; **29-30.** *C. (Tristichotrochus) takaseanus* Okutani, 1972, holotype NSMT (Mo 69534), Japan, 130 m, 9.9 x 8.0 mm.

	H	W	HA	H / W	H / HA
holotype	9.6	7.6	2.1	1.26	4.57
paratype stn DW1101	8.6	7.3	2.1	1.18	4.10
paratype stn DW59	8.6	6.9	2.2	1.25	3.91

Table 3. - *Calliostoma (Fautor) metabolicum* : Shells measurements in mm.

on the whorls are all smooth except P1 which is subgranular, P3 and P4 are about the same size as the other primary and secondary cords, S3 is present, appearing with S1 on the fifth whorl, the basal spiral cords are more numerous and the aperture is not flared.

Calliostoma (Fautor) metabolicum n. sp. may also be compared to *C. (F.) comptum* A.Adams, 1854 (Figs 22-23) from Indo-Pacific, but this species has a greater ratio H/W (1.3-14) with a more cyrtoconoidal shape, all spiral cords distinctly granular and similar in size, and an additional S4.

C. (F.) metabolicum n. sp. may weakly remember *C. (F.) jackelynae* Bozzetti, 1997 (Figs 20-21) from the Philippines which has also a flared aperture, but this much taller species (size about twice greater) has a less ratio H/W (about 1.1), lacks a S2 spiral cord and has all spiral cords distinctly granular except P4 and S4.

Etymology. μεταβολικοζ (Greek : polymorphous) - with reference to the variability of the new species in colours and granularity of spiral cords.

Subgenus ***Ampullotrochus*** Monterosato, 1890
Type species : *Trochus granulatus* Born, 1778 (by monotypy) – Recent, Europe.

Calliostoma (Ampullotrochus) alisi Marshall, 1995

Calliostoma (Fautor) alisi Marshall, 1995: 418, figs 67-69, 132, 157. Type locality: Loyalty Islands, off Lifou, 430 m.

Material examined. Vanuatu. MUSORSTOM 8: stn CP975, 19°24'S, 169°29'E, 536-566 m, 1dd sub. – **Fiji.** BORDAU 1: stn DW1451, 16°45'S, 179°59.5'E, 400-460 m, 1 dd. – Stn DW1453, 16°45'S, 179°59'E, 414-510 m, 1 dd and 2 dd juv.

Distribution. Off Lifou, Loyalty Islands, 425-430 m, Vanuatu, 536-566 m, and Fiji, 414-460 m.

Calliostoma (Ampullotrochus) xanthos
Marshall, 1995
Figs 37-38

Calliostoma (Fautor) xanthos Marshall, 1995: 413-415, figs 58-60, 129, 155. Type locality: southern New Caledonia, 470 m.

Material examined. Fiji. MUSORSTOM 10: stn CP1366, 18°12.4'S, 178°33.1'E, 149-168 m, 1 dd juv. - BORDAU 1: stn DW1417, 16°27'S, 178°55'W, 353 m, 1 dd juv. – Stn DW1475, 19°41'S, 178°11'E, 321-424 m, 1 dd. **Tonga.** BORDAU 2: stn DW1549, 20°38'S, 175°00'W, 500 m, 1 dd sub. – Stn DW1552, 491-500 m, 20°38'S, 174°58'W, 491-500 m, 1 dd juv.

Distribution. Off Lifou, Loyalty Islands, 425 m, south of Ile des Pins, southern New Caledonia, 470 m, off Raoul Island, Kermadec Islands, 390-490 m, Fiji, 168-353 m, and Tonga, 500 m.

Calliostoma (Ampullotrochus) peregrinum
Marshall, 1995

Calliostoma (Fautor) peregrinum Marshall, 1995: 416-417, figs 61-63, 130, 153. Type locality: southern New Caledonia, 235-250 m.

Material examined. Vanuatu. MUSORSTOM 8: stn. DW1058, 16°12'S, 167°21'E, 319 m, 1 dd. - **Futuna Island.** MUSORSTOM 7: stn DW538, 14°13'S, 178°12'E, 441-550 m, 1 dd. – **Tonga.** BORDAU 2: stn DW1586, 18°34'S, 173°55'W, 440-487 m, 1 lv.

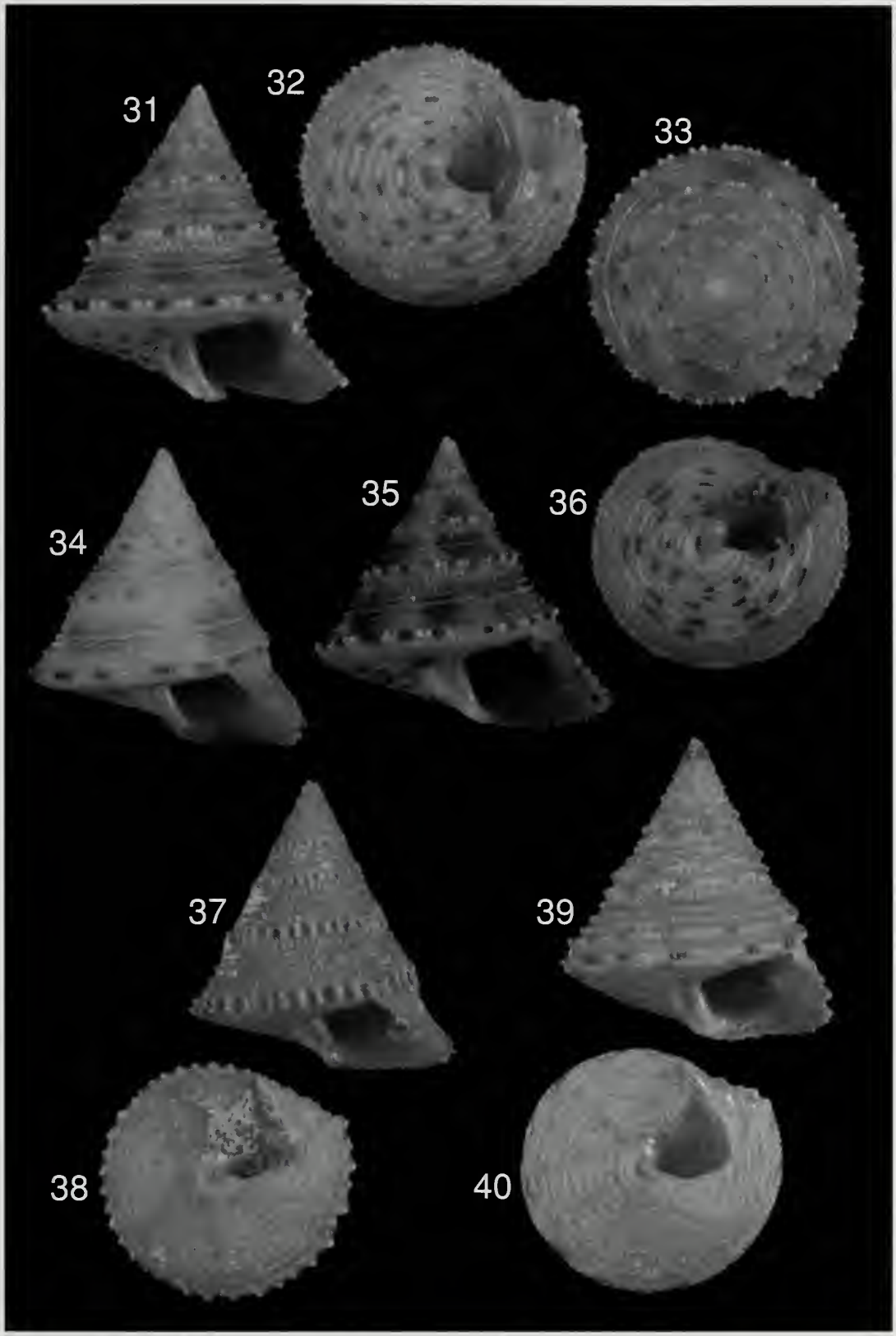
Distribution. South of Loyalty Islands and southern New Caledonia, 233-340 m, northern Three King Rise, northern New Zealand, 841 m, Vanuatu, 319 m, Futuna Island, 441-450 m, and Tonga, 440-487 m.

Calliostoma (Ampullotrochus) xylocinnamomum
n. sp.
Figs 31-36

Type material. Holotype MNHN unnumbered (11.5 x 10.8 mm).

Type locality. Fiji, off Vanua Balavu, 17°08' S, 179°59' W, 360-371 m [BORDAU 1, stn DW1422].

Material examined. Fiji. BORDAU 1: stn DW1422, 17°08'S, 178°59'W, 360-371 m, 1 dd (holotype). - **South-western Pacific**. MUSORSTOM 7: stn DW538, 12°31'S, 176°40'W, 275-295 m, 1 dd. – **Tonga**. BORDAU 2: stn DW1607, 22°15'S, 175°23'W, 356-367 m, 1 dd.



31-33. *Calliostoma (Ampullotrochus) xylocinnamomum* n. sp., holotype MNHN, Fiji, 360-371 m [BORDAU 1, stn DW1422], 11.5 x 10.8 mm; **34.** *C. (A.) xylocinnamomum* n. sp., south-western Pacific, 275-295 m [MUSORSTOM 7, stn DW538], 10.5 x 9.6 mm; **35-36.** *C. (A.) xylocinnamomum* n. sp., Tonga, 356-367 m [BORDAU 2, stn DW1607], 9.9 x 9.8 mm; **37-38.** *C. (A.) xanthos* Marshall, 1995, New Caledonia, Norfolk Ridge, 400-402 m [LAGON, DW838], 10.5 x 9.6 mm; **39-40.** *C. (Benthastelena) pertinax* Marshall, 1995, eastern New Caledonia, 347-375 m [BATHUS 1, stn CP707], 10.4 x 9.3 mm.

Distribution. Fiji, 360-371 m, area at the north-west of Fiji, 275-295 m and Tonga, 356-367 m.

Diagnosis. A *Calliostoma* species of moderate size, almost as wide as high, coeloconoidal in shape, with a moderately elevated spire, an angular periphery, 8 main granular spiral cords on last whorl; peripheral cord strongest, coloured in white and brown segments; adapical cord stronger than other cords; the base is almost flat, bearing about 10 granular spiral cords; no umbilicus.

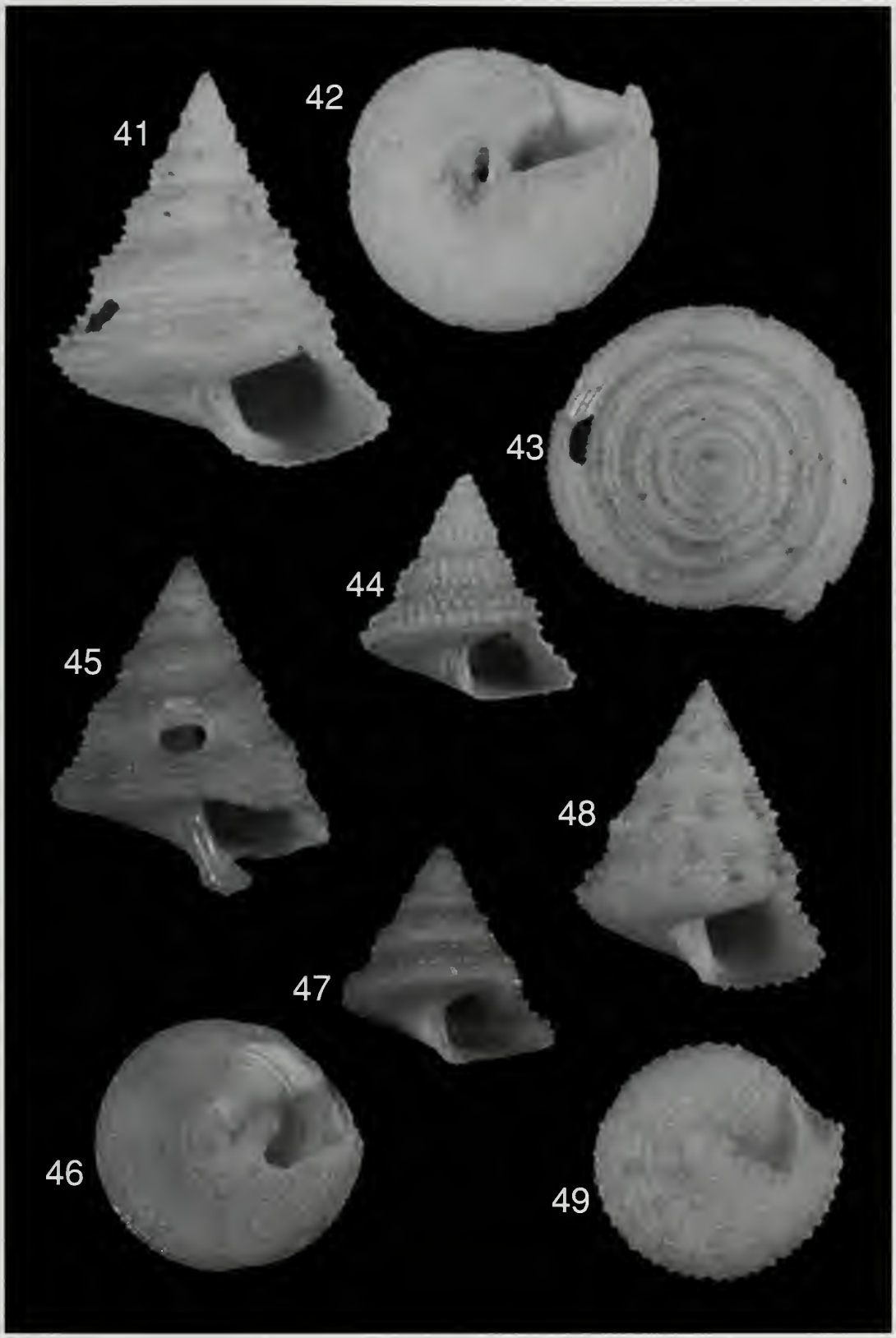
Description. *Shell* rather small for the genus (height up to 11.5 mm, width up to 10.8 mm), conical in shape for adapical part, coeloconoidal in shape for abapical part; spire almost as wide as high, from 3.2x to 4.0 higher than aperture, anomphalous.
Protoconch ca 450 µm in diameter, of 1.25 whorl, covered by network of fine ridges producing rather large polygonal areas; apical fold weakly curved with a thin rounded terminal varix.
Teleoconch of 7.5 whorls, bearing spiral granular cords; whorls nearly flat except last whorl weakly concave. Suture only weakly visible, neither impressed nor channelled. First whorl of teleoconch convex, sculptured by three primary cords; P2 and P4 appearing immediately; P1 starting a bit later, weaker; all cords coarsely granular; prosocline axial ribs between cords, connecting granules of cords; interval between ribs 2 times larger than width of ribs. On second whorl, P3 appearing, granular; P4 becoming stronger than P1 and P2, P1 becoming similar in size to P2; S4 partly emerging from suture, almost completely covered by next whorl. On third whorl, P1, P2 and P3 similar in size, with rounded, distinctly separated, nodules; P4 stronger than other cords, with thicker, bluntly sharp nodules; interval between cords similar in size to the cords; axial ribs becoming broader, interval between them similar in size to ribs. Secondary cords all granular, enlarging to resemble primary cords. S2 appearing between mid fourth whorl and mid fifth whorl; axial ribs becoming obsolete. S1 appearing between mid fourth whorl and beginning of fifth whorl; P1 stronger than other cords, except P4 which is still strongest. S3 appearing between mid fifth whorl and mid sixth whorl. On last whorl, S4 fully visible, peripheral, weaker than other cords, with horizontally elongated nodules; axial sculpture only still visible in area above P1 and P4; in second half of whorl, four tertiary cords appearing, one per interspace between P1, S1, P2, S2 and P3, much finer than other cords.
Aperture subquadrate; outer lip rather thick, almost straight; basal part almost straight, producing a distinct angle with outer lip and only a rounded angle at meeting point with inner part.
Columella curved, oblique, smooth; callus covering umbilicus, completely (holotype) or leaving a thin slit.
Base nearly flat, with 10 granular elevated spiral cords, weakly broader in umbilical area than at periphery; nodules rounded; interval between cords from 1 to 1.5 times size of cords, except the 3-5 outer cords which are more close packed; axial threads between cords very broad in the inner quarters, interval between them smaller than threads.
Colour of protoconch whitish; whorls of teleoconch pink with broad hazel blotches; P4 segmented in white (2-4 beads) and coral brown (1 or 2 beads) areas; base paler, pinkish white, one white spiral cord alternate with one segmented in white (3-5 beads) and coral brown (1-3 beads) areas; callus silver white.
Operculum unknown.

	H	W	HA	H / W	H / HA
holotype	11.5	10.8	3.2	1.06	3.59
specimen stn DW538	10.5	9.6	2.6	1.09	4.04
specimen stn DW1607	9.9	9.8	3.1	1.01	3.19

Table 4. - *Calliostoma (Ampullotrochus) xylocinnamomum* : Shells measurements in mm.

Discussion. *Calliostoma (Ampullotrochus) xylocinnamomum* n. sp. is close to *C. (A.) heros* Marshall, 1995 from Loyalty Islands, but this species has an umbilicus, much finer and more numerous spiral cords on the whorls and on the base, and lacks S3.
The new species may also remember *C. (A.) xanthos* Marshall, 1995 (Figs 37-38) from New Caledonia, Loyalty islands and Kermadec Islands, but this species has much stronger spiral cords with thicker beads and with a interval between cords smaller than the cords, and also basal spiral cords thinner and more close packed.
C. (A.) xylocinnamomum n. sp. looks superficially similar to *C. (Benthastelena) pertinax* Marshall, 1995 (Figs 39-40) from New Caledonia, but this similar in size species has axially elongated beads on spiral cords, S1 starting very late, and P3 and S3 of the same size, giving a different shape to the periphery.

Etymology. ξυλοκινναμωμοσ (Greek : cinnamon wood), used as a noun in apposition - with reference to the light brown colour of the shell.



41-43. *Calliostoma (Benthastelena) arx* n. sp., holotype MNHN, Tonga, 483-531 m [BORDAU 2, stn DW1617], 18.1 x 15.7 mm; **44.** *C. (B.) arx* n. sp., juvenile specimen MNHN, Fiji, 500-516 m [BORDAU 1, stn DW1488], 6.2 x 5.8 mm; **45-46.** *C. (Fautor) vaubani* Marshall, 1995, New Caledonia, 415-460 m [LAGON, stn 475], 11.4 x 9.1 mm; **47.** *C. (F.) vaubani* Marshall, 1995, New Caledonia, 350 m [MUSORSTOM 4, stn DW181], 5.9 x5.5 mm; **48-49.** *C. (F.) houbricki* Marshall, 1995, paratype MNHN, southern New Caledonia, 170 m [CHALCAL 2, stn DW84], 10.5x8.6 mm.

Subgenus ***Benthastelena*** Iredale, 1936
Type species : *Benthastelena katherina* Iredale, 1936 (by o.d.) – Recent, Australia (Queensland).

Calliostoma (Benthastelena) arx n. sp.
Figs 41-44

Type material. Holotype MNHN unnumbered (18.1 x 15.7 mm).

Type locality. Tonga, south of Eua I., 23°03' S, 175°53' W, 483-531 m [BORDAU 2, stn DW1617].

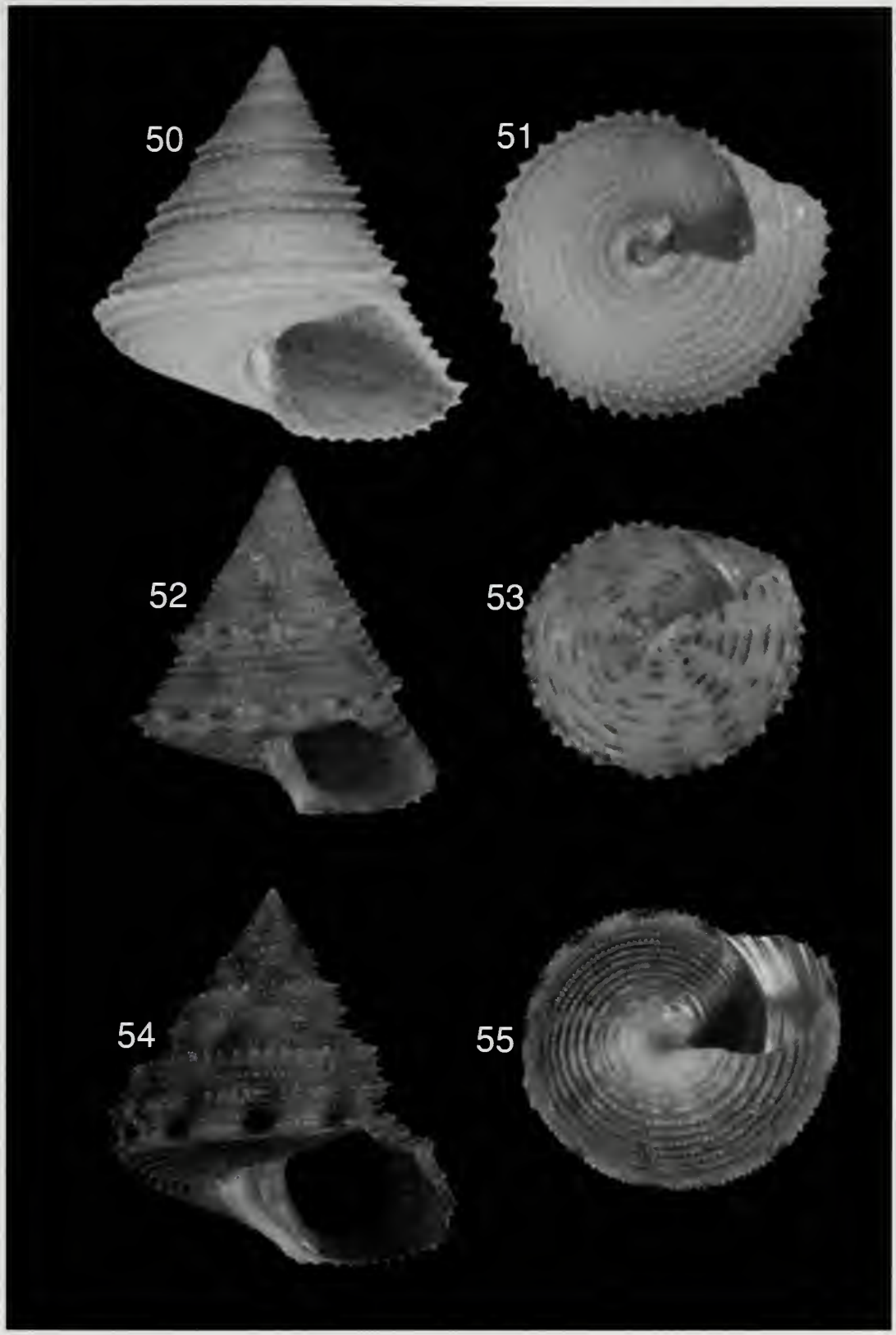
Material examined. Tonga. BORDAU 2: stn DW1617, 23°03'S, 175°53'W, 483-531 m, 1 dd (holotype). **Fiji.** BORDAU 1: stn DW1486, 19°01'S, 178°26'W, 395-540 m, 2 dd juv. – Stn DW1488, 19°01'S, 78°25'W, 500-516 m, 5 dd juv. – Stn DW1492, 18°43'S, 178°23'W, 430-450 m, 1 dd juv.

Distribution. Tonga, 483-531 m and Fiji, 450-500 m.

Diagnosis. A *Calliostoma* species of medium size, higher than wide, coeloconoidal in shape, with an angular periphery, 7 spiny spiral cords on last whorl, the three suprasutural cords forming with the subsutural cord a kind of belt around the suture; base moderately convex, bearing about 12 granular spiral cords; narrow umbilicus.

Description. *Shell* of medium size for the genus (height 18.1 mm, width 15.7 mm), coeloconoidal in shape; spire slightly higher than wide, about 3.8x higher than aperture, narrowly umbilicate.
Protoconch ca 350 µm in diameter, of 1.25 whorl, covered by network of fine ridges; apical fold almost straight with a low rounded terminal varix.
Teleoconch of 8.5 convex whorls, bearing spiral spiny cords. Suture visible, impressed, not channelled. First whorl of teleoconch convex, sculptured by three primary cords; P2 and P3 appearing immediately, P1 starting a quarter of whorl later, weaker; all cords coarsely granular; prosocline axial ribs in the intervals between cords, connecting granules of cords; interval between ribs 1.5 times larger than width of ribs. On second whorl, P3 strongest, P1 weakest; all beads distinctly sharp; interval between ribs becoming 2 times larger than width of ribs. On third whorl, P4 slightly emerging from suture, still almost completely covered by next whorl. On fourth whorl, P4 fully visible, weaker than other cords; distance between P3 and P4 smaller than distance between P1, P2 and P3. On fifth whorl, sharp beads of P2 and P3 adapically oriented at 45°, beads of other cords still horizontally oriented; P4 almost as strong as P3; axial threads becoming obsolete, except between P3 and P4. On sixth whorl, beads of P3 becoming nearly vertically oriented; S4 appearing, almost completely covered by next whorl, with beads already sharp; S1 commencing, very thin, granular. On seventh whorl, beads of S1 becoming sharp; S2 starting at the end of whorl, granular; beads of S1 oriented at 45°. S3 absent. On last whorl, S4 fully visible; P3, P4 and S4 strongest.
Aperture subquadrate; outer lip rather thick, almost straight; basal part slightly curved, producing a pronounced angle at meeting point with outer part and an obtuse rounded angle with inner lip.
Columella straight, oblique, smooth; callus covering partially umbilicus. Umbilicus narrow (about 1/10 of width of base) but deep.
Base weakly convex, with 12 rather thin granular spiral cords; interval between cords from 1.5 to 2 times size of cords; low broad axial threads between cords connecting granules of spiral cords.
Colour of protoconch translucide white; teleoconch cream white.
Operculum unknown.

Discussion. The general shape of the whorls of *Calliostoma (Benthastelena) arx* n. sp. remember those of *C. (Fautor) vaubani* Marshall, 1995 (Figs 45-47) from New Caledonia (juvenile specimens especially look similar), but this smaller species lacks an umbilicus and has much more close packed spiral cords, a different combination of secondary cords (S2 appears before S1 and S3 is present) and rounded, not sharp, beads on cords.
C. (B.) arx n. sp. looks superficially similar to *C. (Fautor) houbricki* Marshall, 1995 (Figs 48-49) from New Caledonia, but this smaller species lacks an umbilicus, has thicker and rounded, not sharp (at most roundly conical) beads on cords and especially a different combination of secondary cords (S3 appears before S1 and S2 is absent).
The new species may also remember *C. (Tristichotrochus) paucicostatum* Kosuge, 1984 (Figs 50-51) from the Philippines, but this similar in size species again lacks an umbilicus, has beads of spiral cords much more separated and a primary P1 of the same size as S1 and P2.
C. (B.) arx n. sp. looks also a little like *C. (Ampullotrochus) suduirauti* Bozzetti, 1997 (Figs 52-53) from the Philippines, but, again, this species lacks an umbilicus, has rounded axially elongated beads on spiral cords except on P3, S2 appearing before S1, P1 of the same size as P2, S1 and S2, and P4 the weakest off all, giving to the sutural area a very different shape.
The subgenus *Benthastelena* Iredale, 1936 was chosen for the new species on account of its conchological affinities with some Japanese species with sharp beads on spiral cords, as for example *Calliostoma (Tristichotrochus) aculeatum* (Sowerby, 1912) (Figs 54-55); we follow here Marshall (1995) who synonymised the well known subgenus *Tristichotrochus* with the prior *Benthastelena*.



50-51. *Calliostoma (Tristichotrochus) paucicostatum* Kosuge, 1984, holotype IMT (IMT-84-46), Philipines, Cebu, 19.2 x 18 mm; **52-53.** *C. (Ampullotrochus) suduirauti* Bozzetti, 1997, holotype MNHN, Philippines, 140 m, 13.8 x 12.2 mm; **54-55.** *C. (Tristichotrochus) aculeatum* (Sowerby, 1912), Japan, 17.8x16.0, coll. C.Vilvens.

Etymology. Stronghold (Latin), used as a noun in apposition - with reference to sharp beads of spiral cords that are reminiscent of weapons like arrows.

Genus ***Bathyfautor*** Marshall, 1995
Type species : *Bathyfautor rapulia* Marshall, 1995 (by o.d.) – Recent, New Zealand.

Bathyfautor caledonicus Marshall, 1995

Bathyfautor caledonicus Marshall, 1995: 421-423, figs 76-78, 134, 157. Type locality: southern New Caledonia, 775 m.

Material examined. Vanuatu. MUSORSTOM 8: stn DW1048, 16°40'S, 168°04'E, 450-489 m, 1 dd.

Distribution. New Caledonia, 550-1005 m, and Vanuatu, 450-489 m.

Bathyfautor coriolis Marshall, 1995

Bathyfautor coriolis Marshall, 1995: 423-424, figs 73-75, 154. Type locality: Chesterfield Islands, 630 m.

Material examined. Fiji. MUSORSTOM 10: stn CP1341, 16°52.5'S, 177°43.7'E, 500-614 m, 2 dd. - Stn CP1342, 16°46'S, 177°39.7'E, 650-701 m, 1 lv. – BORDAU 1: stn CP1397, 16°33'S, 179°52'W, 674-688 m, 1 dd.

Distribution. Off Chesterfield Islands and Lansdowne Bank, 630-705 m, and Fiji, 614-674 m.

ACKNOWLEDGEMENTS

I would like to thank warmly P. Bouchet (Muséum national d'Histoire naturelle, Paris) for reading the manuscript, constructive advises and access to the malacological resources of the MNHN, and V. Héros (MNHN) for her help in my search of various scientific papers.
Also, I am very especially grateful to J.L. Van Goethem (Institut royal des Sciences naturelles de Belgique) for his constant help, particularly to borrow types.
I also would like to thank S. Kosuge (Institute of Malacology, Tokyo), R. Moolenbeek (Zoölogisch Museum, Amsterdam) and H. Saito (National Science Museum of Tokyo) for their constant help and the loan of types of various *Calliostoma* species.
Thanks are also due to Mrs M. Pâque for her help in the use of Ancient Greek language.

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